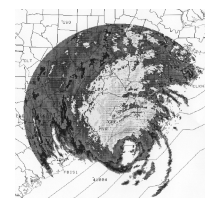


# Carolina Skies

Hurricane Floyd September 15-16, 1999



National Weather Service, Wilmington, NC

Summer 2001

## Hurricane Season 2001

### NOAA Weather Radio

The NWS has used an automated voice to broadcast warnings and other information for the last couple of years. The purpose was to get warnings out faster, with no human interaction. The "voice" was original synthesized voice technology, first developed to read to the blind. As technology evolved, the NWS has investigated new voices. **To listen to the possibilities and even vote for the voice of your choice, go on-line to:** <http://www.nws.noaa.gov/nwr/voicesamples.htm>

It is expected that the new voice will be on the air around Christmas 2001.

**WATCH:** Severe weather is possible within the designated watch area. Be alert!

**WARNING:** Severe weather has been reported or is imminent. Take necessary precautions.

### Hurricane Season Outlook

It didn't take long...just five days into the season before Allison formed as a tropical storm just off the Northeast Texas coast on June 5. Allison moved ashore that night at Galveston and lingered in the Houston area where it dropped around 36 inches of rain over the next six days, causing a record-setting flood. Allison moved back out to the Gulf of Mexico and then came ashore in Mississippi on the 11<sup>th</sup>, causing scattered tornadoes and heavy rains as it crossed the Southeast U.S. As the remnants of Allison crossed NE SC and SE NC from June 14-16, rainbands in the circulation caused heavy accumulations...more than six inches in eastern Bladen and southern Pender Counties, more than four inches in parts of Marlboro and Georgetown Counties, and three inches or less elsewhere.

While damage in Texas alone is estimated around \$4 billion, at least 50 deaths from Texas to Virginia were blamed on Allison.

The outlook for the rest of hurricane season is for above-average activity...especially along the East Coast, since the Atlantic Ocean continues its warmer-than-normal trend since 1995. It appears the Pacific Ocean will not develop El Nino conditions, and it looks like a general area of lower-than-normal surface pressure will continue in tropical cyclone formation areas in the tropics and the Gulf of Mexico. There will be little to hinder hurricane development.

Colorado State University's Dr. Bill Gray revised his forecast upward in June, calling for 12 Tropical Storms, of which seven will develop into hurricanes, of which three will become major (category 3 or worse). The long term averages are nine tropical storms, five hurricanes, two major.

This is a hurricane season to take very seriously...to even fear! Fear is a healthy motivator - it forces us to take action to prepare before hurricanes impact us. Fear is better than panic, which weakens us by robbing us of our good sense.

### Skywarn Spotters

Severe weather activity was fairly light until April, when a 4 ½ hour severe weather episode on April 1 prompted 33 severe thunderstorm warnings. Thanks to our Skywarn Spotters, Law Enforcement and Emergency Managers, we were able to confirm wind damage, hail and flooding events and verify 22 of the warnings.

During May we had five days when often marginally severe weather developed over the area and we issued a total of 27 warnings, verifying 13

of them...and we missed six events where damage was reported. We base our warnings largely on Doppler Radar information, and during marginally severe events, the decision to not warn is often as difficult as deciding to warn.

Skywarn Spotter Training continues, and we seek opportunities to train more spotters whenever and wherever we can. We can do a better job warning and protecting you and your neighbors if we have your help. Those who complete basic training receive certificates of completion and are assigned ID numbers.

Advanced Spotter Training goes beyond the basics, and those who complete this course receive embossed sew-on patches.

Please contact us to arrange spotter training for your group, or look at our web page to see where spotter training is scheduled in your area.

## Hurricane Hunter Visits Florence SC

The famed Hurricane Hunters of NOAA's National Weather Service greeted the public and gave tours of their P3-Orion Hurricane Hunter plane as part of a Hurricane Awareness event at the Florence Regional Airport on May 10. There were displays and handouts.

"The public are not generally aware of the hazards posed by hurricanes", said Max Mayfield, Director of the National Hurricane Center in Miami. "By

showcasing the Hurricane Hunters and their aircraft, we are raising the awareness of the estimated 48 million people living in harm's way within 50 miles of the Gulf and Atlantic coasts."

Hosting the hurricane experts were the Florence County Emergency Management Team, including Project Impact, as well as the National Weather Service Office in Wilmington N.C.

Besides the public tours, NWS Wilmington's Reid Hawkins and Tom Matheson gave many half-hour presentations to about 600 5th graders. Students, TV and other media from Wilmington to Myrtle Beach to Florence to Columbia toured the aircraft, talked with NWS folks and interviewed Max and the aircrew.

## Hurricanes in the Recent Past

A hurricane, a thing of such spectacular beauty in nature, only becomes a disaster when it comes in contact with humans. We name these storms and they take on an identity, and in the personality conflict between human will and Mother Nature, she wins every time!

Let's do a review of the recent tropical cyclones that made landfall in the Carolinas.

**1989 - Hugo** - September 22, Category 4, came ashore just after midnight at Bulls Bay, between Charleston and Georgetown with about 20' storm surge and moved inland at 25

mph, causing a trail of extensive damage across Eastern South Carolina and into Central North Carolina. One of the costliest hurricanes in history.

**1996 - Bertha** - July 12, Category 2, came ashore just north of Cape Fear near Topsail Beach, NC - the only Cape Verde hurricane (developed from an atmospheric wave originating off Cape Verde, Africa) in history to make landfall in the U.S. in July.

**1996 - Fran** - September 5, Category 3, came ashore near Cape Fear, NC and did extensive damage inland to Raleigh and beyond. Twenty-one people died in North Carolina.

**1998 - Bonnie** - August 26, Category 2, came ashore near Cape Fear, NC and moved slowly up the coast...about 50 miles in 12 hours, causing widespread flooding.

**1999 - Dennis** - September 4, Tropical Storm, the center of Dennis passed South Carolina about 100 miles off the coast as a Category 2 hurricane on August 29, only to stall about 100 miles off the NC Outer Banks, gradually weakening before making landfall just north of Cape Lookout. Dennis dumped heavy rain across Eastern NC, setting the scene for the flooding from Floyd.

**1999 - Floyd** - September 16, Category 2, came ashore just north of Cape Fear near Topsail Beach. Heavy rains associated with Floyd fell on Dennis-saturated Eastern NC and Horry County, SC, causing near-record or record-breaking flooding of all

the rivers in the area. More than 50 deaths were associated with fresh water flooding, and thousands were displaced.

In the recent past, other hurricanes and tropical storms made landfall elsewhere and crossed the Carolinas, causing flooding and loss of life. Josephine '96 and Helene '2000 are notable.

We need to remember that freshwater flooding is the #1 killer component of hurricanes.

## **A Deadly Current: The Rip**

Each summer, millions of people visit the beaches of the United States to spend their vacations. Unfortunately, thousands of these people may swim into the grasps of a killer...a rip current. In fact, according to the United States Life Saving Association (USLA) there were over 23,000 rip current related rescues in 1999 alone. The USLA estimates there are around 100 people that die from rip currents each year. That is more than the average yearly deaths attributed to lightning and tornadoes!

A rip current is defined as a channel of water that flows away from the beach and is comprised of three basic parts. The feeder portion is the main source of energy for the current. The neck, which is the most dangerous part of the current, is where the water is moving away from the beach. The speed in this part of the current can exceed 4 or 5 knots! The head is the final portion of a

rip where the current becomes less focused and begins to diverge outward.

Since rip currents can exceed the speed of an olympic swimmer, it is no wonder why these features can be so dangerous. People often find themselves getting farther and farther away from the beach and begin to panic. When panic sets in, people tend to forget how to react safely. Unfortunately, many people try to swim directly against the current and all that does is weaken the swimmer even further.

Observation and awareness are the keys to avoiding rip currents. Be aware of your surroundings, and look for clues that may tell you that a rip current is in the area. Especially avoid areas where the water has a muddy appearance from its surroundings. The water may also be seen flowing seaward, which would signify a rip. Most importantly, if you are not sure, ask a lifeguard for information.

If you become caught in a rip current, do not panic or swim against the current. Swim parallel to shore until you are out of the rip. If you cannot break out of the current, float calmly until its effects diminish, usually just beyond the breakers. Then swim diagonally to shore. If you do not swim well, stay close to the beach. Also, stay in areas where lifeguards are watching the beach.

There were several rip current fatalities in the Carolinas last year. As a result, the

National Weather Service in Wilmington has begun issuing daily rip current potential forecasts. A scheme has been developed to identify features that would signal the threat for dangerous rip currents. These signals include large period swell and persistent onshore wind fetches. New wave models, such as the NOAA Wave Watch III model and detailed wave spectra data from NOAA Weather Buoys help us to identify the potential for rip currents.

This information can be found on our web site at: <http://nwsilm.wilmington.net/rip/ripmain1.html> or to view the daily rip current potential forecast, review the Recreational Beach Forecast, which is issued two times a day at: <http://nwsilm.wilmington.net/fcsts/beachfcst.shtml>

Please contact Steve Pfaff ([steven.pfaff@noaa.gov](mailto:steven.pfaff@noaa.gov)) if you have any questions or comments.

## **Lightning Awareness**

### **Indoors**

- Stand clear from windows, doors and electrical appliances.
- Unplug appliances well before a storm nears - never during.
- Avoid contact with piping including sinks, baths and faucets.
- Do not use the telephone except for emergencies.

**Outdoors** - Look for a shelter immediately! If you're caught outside and unprotected:

- Get in a hard topped car.
- Never use a tree as a shelter.
- Avoid areas that are higher than the surrounding landscape.
- Keep away from metal objects including bikes, golf carts, fencing, machinery, etc.
- Avoid standing near tall objects.
- Immediately get out and away from pools, lakes, and other bodies of water.
- Spread out - don't stand in a crowd of people.
- If you feel a tingling sensation or your hair stands on end, lightning may be about to strike! Immediately crouch down and cover your ears. Do not lie down or place your hands on the ground.

Victims of lightning shock should be administered CPR if necessary, and seek medical attention immediately.

## **New Forecasts Issued by NWS Wilmington**

Maybe more important than the new forecasts is the dawn of a new age, and a new process by which we issue the forecasts. We now are beginning to interact with the new NWS AWIPS (Automated Weather Information Processing System) GFE (Graphical Forecast Editor) to generate a data base from which forecasts are automatically "written."

The NWS has always been at the cutting edge of technology. In the 1870's, the U.S. Weather Bureau made extensive use of

the newly developed telegraph system, as well as the recently invented typewriter. When IBM developed its first computers, guess who was one of their first customers! The atmosphere is infinitely complex, and the NWS must use all resources available to do its best job of analyzing and forecasting.

As computer technology evolved, the NWS has worked to streamline operations and increase observation, forecast and warning capabilities in all aspects - from the Automated Surface Observation Systems (ASOS) to observe conditions to NOAA Weather Radio to broadcast warnings, using the Emergency Alert System.

With AWIPS, forecasters are able to examine current ASOS, data buoy, satellite and radar observations and compare them to sophisticated forecast model output...but until recently, we still composed forecasts using a conventional word processor. Now, forecasters are entering the sensible weather parameters (temperature, wind, humidity, precipitation, precipitation probability, cloud cover) into a matrix with three hour intervals for the first couple of days...and then at six hour intervals to seven days. From this matrix, the County (Zone) forecasts are generated. Aviation and Fire Weather forecasts are also largely automated. Short-fuse Tornado, Severe Thunderstorm and Flash Flood warnings are automated as well. The forecaster still types up Coastal

Waters Forecasts, Recreational Beach Forecast, and other statements.

With the GFE, forecasters will not fill out a matrix, but instead will interact with a map of the area, drawing pictures of sensible weather parameters for the next week in an effort to further streamline the difficult forecast process, allowing the forecaster more time to study the enormous amount of information continually feeding into the AWIPS system.

One result of the matrix forecast process is the digital forecast matrix, which is available on the NWS Wilmington website, along with all the other forecasts we issue. *See an example on Page 7.*

## **Hurricane Season**

Hurricane season is actually half the year, six months long, from June through November... kind of like a rainy season in other parts of the world, when the warm, humid influence of the tropical regions spreads into the middle latitudes. Those six months are also about 50% wetter in the coastal Carolinas, but we don't call that period the rainy season - it is hurricane season!

In the National Weather Service, we also issue a forecast twice daily for forest fire management agencies. Fire activity usually peaks in late August or early September, while hurricane activity peaks at about the same time... mid-September.

Hurricanes and forest fires perform a similar function - they produce and exhaust heat vertically, away from the source. Forest fires exhaust heat when combustible fuels and oxygen are mixed at the ignition temperature. Forest fires sometimes focus heat exhaust in spinning tornadoes. Hurricanes are bigger - they may cover thousands of square miles of warm ocean, and when warm, high-energy water vapor condenses into low-energy liquid rain, the heat of condensation is exhausted vertically - the hurricane acts much like a chimney, much like a jet engine.

While hurricanes are not hot like fires, they are both concentrated sources of heat exhaust, and the amount of heat exhausted from a large hurricane is similar to the heat from a World War II atomic bomb every five or ten seconds. The unique properties of water - how it transports heat through evaporation and condensation - are what allow hurricanes and other violent storms to develop. Water is the fuel!

## Climate Corner

The winter months of December, January, and February were cooler and drier than normal across the Eastern Carolina's, and continued the below normal trends for each of these categories that were established during the fall months. Temperatures during this period averaged 1.3 degrees below normal overall for

Southeast North Carolina and Northeast South Carolina. The coldest month by far was December, where temperatures area-wide averaged nearly seven degrees below normal. Numerous low temperature records were broken during this period. Wilmington experienced the sixth coldest December on record. In addition, one of the longest cold spells this area had experienced in some time occurred in latter part of December and the first week of January. Wilmington, for example, experienced 21 straight days of minimum daily temperatures at or below freezing from December 20 to January 7. The lowest official temperature recorded in the area during this cold spell was in Lumberton, where the mercury bottomed out at 14 degrees. Many other locations also experienced temperatures in the 14 to 17 degree range. But, a warming trend began to take hold in early January, and although the month of January was still below normal overall, it wasn't nearly as cold as it had been in December. February ended up on a much warmer than normal note.

Precipitation continued to run well below normal for the entire area for each of the months of December, January, and February. Most locations averaged about one and a half to two inches below normal for each month. Very little snow was experienced across the area during the winter months, mainly

due to the overall lack of precipitation. But, most locations did experience at least some snow flurry activity. Some sleet and ice also occurred, mostly in North Carolina, but it wasn't nearly as serious as it was in central and northern portions of North Carolina. Portions of central South Carolina continue to experience a moderate drought.

A persistent upper level trough, which had dominated the east coast of the United States in the summer and fall months, continued to affect the area during the winter months. This allowed the jet stream to dip deep into the southeast U.S. The resulting northwest wind flow caused cold air already in place over the region to be continuously reinforced, which didn't allow the airmass to warm up much. Only until the jet stream retreated a little further to the north in January did temperatures begin to warm up.

## Hurricane Expos

The NWS works to issue accurate forecasts and warnings, but we also get out to educate the folks in our 14 county area. Talks are given frequently to Chambers of Commerce, fraternal organizations, etc. Others are involved in beating the preparedness drum...it is everyone's responsibility! The annual New Hanover County NC Hurricane Expo on June 2 was attended by around 8,000 people who learned more about hurricane preparedness. A

wide array of companies and agencies displayed their wares and gave demonstrations on home retrofitting and wind damage potential. The NWS, with assistance from Amateur Radio volunteers, had a display and talked about hurricanes with families that stopped by.

The Surfside Beach, SC Hurricane Impact Conference on June 14 was attended by around one thousand people, and besides the displays, a group of speakers talked to the audience about the upcoming season, insurance issues and evacuation procedures.

## Hurricane Safety Rules

When a **Hurricane Watch** is Issued for Your Area...

- Listen to local officials
- Check often for official bulletins on radio, TV or NOAA Weather Radio
- Fuel car
- Check mobile home tie-downs
- Moor small craft or move to a safe shelter
- Stock up on canned food
- Check supplies of special medicines and drugs
- Check radio and flashlight batteries
- Secure lawn furniture and other loose material outdoors
- Tape, board, or shutter windows to prevent shattering
- Wedge sliding glass doors to prevent lifting from their tracks

When a **Hurricane Warning** is Issued for Your Area...

- Listen to local officials
- Stay tuned to radio, TV or NOAA Weather Radio
- **Stay home if sturdy and on high ground**
  - ▶ Board up garage and porch doors
  - ▶ Move valuables to upper floors
  - ▶ Bring in pets
  - ▶ Fill containers (bathtub) with several days supply of drinking water
  - ▶ Turn up refrigerator to maximum cold and don't open unless necessary
  - ▶ Use phone only for emergencies
  - ▶ Stay indoors on the downwind side of the house away from windows
  - ▶ Beware of the eye of the hurricane
- **Leave mobile homes**
- **Leave areas which might be affected by storm tide or stream flooding**
  - ▶ Leave early - in daylight, if possible
  - ▶ Shut off water and electricity at main stations
  - ▶ Take small valuables and papers but travel light
  - ▶ Leave food and water for pets (shelters will not take them)
  - ▶ Lock up house
  - ▶ Drive carefully to nearest designated shelter using recommended evacuation routes

## What is a Hurricane?

A hurricane is a type of tropical cyclone - the general term for all circulating weather systems (counterclockwise in the Northern Hemisphere) over tropical waters. Tropical cyclones are classified as follows:

**Tropical Depression** - An organized system of clouds and thunderstorms with a defined circulation and maximum sustained winds of 38 mph (33 knots) or less.

**Tropical Storm** - An organized system of strong thunderstorms with a defined circulation and maximum sustained winds of 39 to 73 mph (34-63 knots).

**Hurricane** - An intense tropical weather system with a well defined circulation and maximum sustained winds of 74 mph (64 knots) or higher. In the western Pacific, hurricanes are called "typhoons" and similar storms in the Indian Ocean are called "cyclones".

**Storm Surge: Storm surge is a large dome of water often 50 to 100 miles wide that sweeps across the coastline near where a hurricane makes landfall. Along the immediate coast, storm surge is the greatest threat to life and property.**

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 RDFILM  
 DIGITAL ZONE FORECAST MATRICES  
 NATIONAL WEATHER SERVICE WILMINGTON, NC  
 949 PM EDT WED JUN 20 2001

NCZ087-096-099-SCZ017-024-211349-  
 BLADEN-COLUMBUS-DILLON-MARLBORO-ROBESON-  
 INCLUDING THE CITIES OF...BENNETTSVILLE...DILLON...ELIZABETHTOWN...  
 LUMBERTON...WHITEVILLE  
 949 PM EDT WED JUN 20 2001

	\ THU 06/21/01										\ FRI 06/22/01										\			
EDT	15	18	21	00	03	06	09	12	15	18	21	00	03	06	09	12	15	18	21	00	03	06		
POP 12HR						10				20						20				30		30		
QPF 12HR						0		.10	.24				.01	.10		.25	.49		.25	.49				
MAX QPF						0		.10	.24				.01	.10		.25	.49							
MN/MX						67				88						68				87		70		
TEMP	75	73	71	74	79	84	85	81	78	75	73	75	80	85	86									
DEWPT	70	70	70	70	69	68	70	71	71	72	72	71	72	71	70									
RH	84	90	97	87	72	59	61	72	79	90	97	87	77	63	59									
WIND DIR	N	N	N	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	--	--	--	SW					
WIND SPD	2	2	2	2	5	10	5	5	2	2	5	0	0	0	2	5	5	2	2					
CLOUDS	SC	SC	B1	B2	SC	B1	B2	B1	SC	B1	B1	B2	SC	B2	B1	B1	B1	B1	B1	B1	B1			
RAIN SHWRS							S	S	S	S						C	C	C	C	C	C			
TSTMS							S	S	S	S						C	C	C	C	C	C			
OBVIS																								

	\SAT 06/23/01				\SUN 06/24/01				\MON 06/25/01				\TUE 06/26/01			
EDT	09	15	21	03	09	15	21	03	09	15	21	03	09	15	21	03
POP 12HR	30	30	30	20	20	0	0	0	0	0	0	0				
MN/MX	87	67	86	68	85	69	88	70	90							
CLOUDS	B1	B2	B1	SC	SC	SC	B1	SC	SC							
RAIN SHWRS	C	C	C	S	S											
TSTMS	C	C	C	S	S											

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<b>DEC</b>		<b>JAN</b>		<b>FEB</b>		<b>WINTER</b>	
TMP	DEP RAIN/DEP	TMP/DEP	RAIN/DEP	TMP/DEP	RAIN/DEP	TMP/DEP	RAIN/DEP
<b>WILMINGTON</b>							
41.4	/-7.1 1.64/-1.99	45.5	/-0.6 0.68/-3.19	51.5	4.2 2.28/-1.42	46.1	/-1.2 1.53/-2.2
<b>NORTH MYRTLE BEACH</b>							
41.2	/-6.3 1.51/-1.79	43.5	/-3.2 1.08/-2.22	49.7	1.8 2.72/-0.70	44.8	/-2.3 1.77/-1.6
<b>FLORENCE</b>							
40.1	/-7.3 0.84/-2.30	45.5	1.7 1.49/-2.04	52.1	5.0 1.98/-1.38	45.9	/-0.6 1.44/-1.9
<b>OVERALL</b>							
40.9	/-6.9 1.33/-2.03	44.8	/-0.7 1.08/-2.48	51.1	3.7 2.33/-1.17	45.6	/-1.3 1.58/-1.9